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FACTORS AFFECTING THE OUTCOME OF TREATMENT OF PULMONARY TUBERCULOSIS IN SUB-OPTIMAL CONDITIONS:

An 18-month Follow-up of 224 Patients

By

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Laser Therapy in the Treatment of Detached Retina

REPORT ON A SUCCESSFUL CASE

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Laser is still a new weapon in the service of medicine and its main clinical value is in the treatment of detached retinae. The object of this paper is to report on the successful outcome in a particularly difficult type of detached retina in a young woman — incidentally, the first reported case in Rhodesia — and also to stress the type of case in which we have found Laser to be of most value.

Laser is another of those initial words to which we have become increasingly accustomed in this technicological world and stands for Light Amplification by Stimulated Emission of Radiation.

The power unit of this laser ophthalmoscope — illustration shown opposite — provides high voltage (direct current) for the Xenon flash tube, which is spirally set around a 6-inch rod of synthetic ruby crystal. Bursts of light from the lamp excite chromium atoms within the ruby to a higher state of energy. As the atoms return to normal they give off their energy as light. Only that part of the light aimed out through a small hole at one end of the ruby escapes in the form of an even, intense laser beam. A single burst is visible for only a fraction of a second.

By using a pulsed ruby laser emitting monochromatic light of 6943A, which is wholly transmitted by the clear media of the eye, this ophthalmoscope can produce phototherapy on the retina. Unlike "white" light from the sun or an electric light bulb (which radiates in all directions and consists of a whole spectrum of colours), light waves from a laser are disciplined or "coherent". They are only one colour, i.e., all the same frequency, and they all emerge from the laser in step, i.e., in phase with each other travelling along precisely parallel lines. The result is a narrow beam of red light of 400 trillion unbroken waves a second. This concentration of light energy is powerful enough to cut through a diamond in two microseconds.

These enormously high power densities in exceedingly small areas account for the ability of the laser beam to penetrate hard solid materials and to vaporise tissues.

It should be clearly recognised that the point of action of the laser is the point at which it is stopped. It travels in exactly the same way as light — that is, through all transparent media, but not through opaque media. So that in the eye, if the laser is focused on an area of retina which is in apposition, or very nearly so, with the pigmented choroid, the histological changes will occur there. However, if there is any real separation between retina and choroid — as in most detached retinae — no reaction in the retina can be expected. It is, therefore, very important in laser therapy to ensure that the area of the retinal holes or tears are in close apposition to the underlying choroid, otherwise there will be a relative absence of reaction. Drainage of subretinal fluid may therefore be a necessary preliminary step to laser coagulation. The histological changes described after a burst of laser are swelling of the retinal layers and loss of cellular structure. Chorioretinal adhesions may be demonstrated by the third day and are well developed by the fifth day. Once a mature chorioretinal adhesion has been produced there is little subsequent change, extensive fibrosis and contraction not occurring.

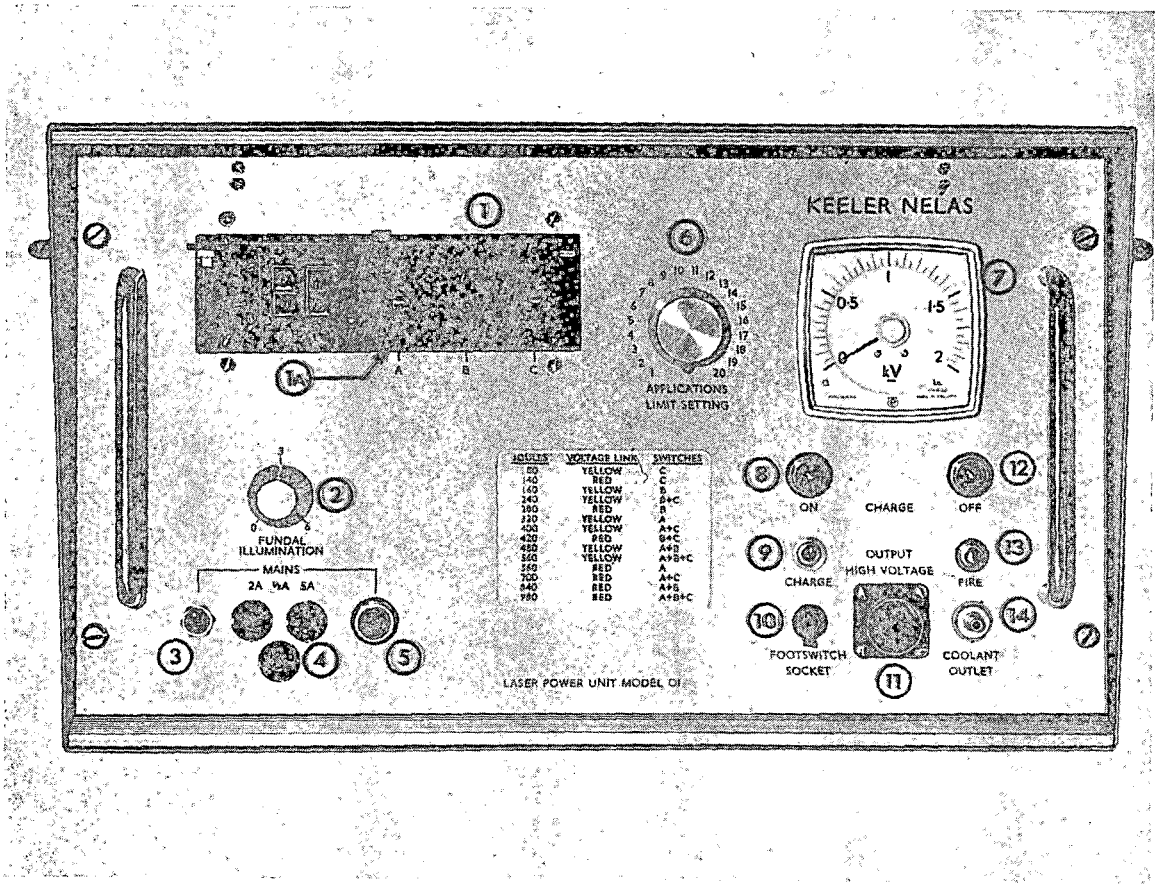
Retinal coagulation with the ruby laser photocoagulator is at its best use in the narrow area between the optic disc and the macula and in the close environs of the central macular area. This is due to the fact that the beam can be focused to an exceedingly fine point and retinal tears can be repaired with minimal destruction to the surrounding normal tissue.

In contrast, operative procedures are at their very worst in this central area, where the great practical difficulty in reaching and exposing adequately the posterior pole of the eye and the relative clumsiness of the diathermy or cryothermy procedures results almost always in destruction of the macula and loss of the vital central vision. So that even with good theoretical cure of the retinal detachment, the patient is very little better off in that his accurate central vision is permanently lost.

Another big advantage of laser is that no anaesthesia of any kind is required — not even surface (local) anaesthesia.

This is due to the fact that the focused retinal application is associated with a high *image* temperature, but only a very small bulk tissue temperature, and so there is a relative absence of a heating effect on the patient. Also the ability to produce a retinal application in under 1/1,000th of a second means fixation of the globe is unnecessary.

It must, however, be fully realised that laser does not supersede the standard detached retina operations: where the tear in the retina is peripheral rather than central, focusing of the laser



may be difficult, if not impossible, and operative procedures are at their easiest.

Laser, therefore, complements rather than replaces the standard procedures for the cure of retinal detachment, and the following case is an excellent example of one which is particularly suitable for laser therapy.

CASE ILLUSTRATION

A European girl, now aged 18 years, was first seen in March, 1966, complaining of poorer vision in the right eye. She gave a history of a stone injury to the eye six months previously.

Apart from a traumatic mydriasis, she had macular changes, a choroidal rupture near the disc and linear paramacular damage in the upper temporal quadrant. The unaided vision in the right eye was 6/5 part with great difficulty. The left could read 6/5.

In August, 1969, the right vision deteriorated due to a retinal detachment which involved the lower half of the retina. A tear was visible in the area of previous paramacular damage.

Diathermy was applied over the torn retina extending from within one millimetre of the macula to the equator of the eye. Drainage of sub-retinal fluid, by suction through a scleral incision and perforation of the choiroid below, gave a replaced retina before leaving the operating theatre.

Convalescence was uneventful, although traction lines could be seen radiating from the diathermised area towards the macula. The retina remained flat until mid-October, when a small macular hole appeared and the detachment recurred.

At this stage it was considered that laser therapy would be the best type of treatment, and on 17th October, 1969, she was admitted to the Salisbury Hospital Annexe. Three bursts of laser at 480 Joules were administered to the central tear; this resulted in some small haemorrhages appearing in the area, so further treatment was discontinued. At the end of October the patient still showed central haemorrhages and some subretinal fluid inferiorily. Two weeks later a larger macular hole had appeared and there was an inferior balloon detachment of the retina.

Fig. 1—Limiting the extension of a detachment across the line of a circlage suture.

Re-operation was undertaken on 24th November, 1969, under general anaesthetic. Two small perforating diathermy holes were made in the lower sclera and the subretinal fluid was drained.

At this re-operation a slightly higher setting of 560 Joules was decided on, as the marks from the first applications were poor and it was felt that the haemorrhages seen after these applications were in fact a fragmentation and surfacing of a subretinal haematoma from the original diathermy operation.

Thirteen laser applications were made right round the central retinal hole. The patient was kept

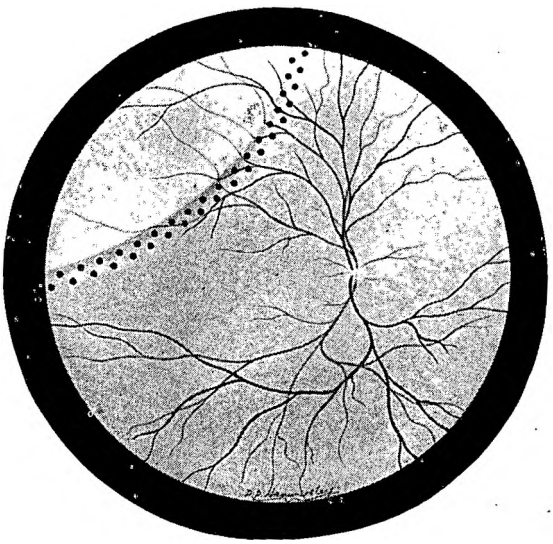


Fig. 3—Large cysts of the retina may be sealed off and extension—if threatened—prevented by multiple rows of applications at the margin of the cyst.

double padded and on strict bed rest for 10 days. The hole appeared well sealed seven days after the operation and the detachment settled steadily.

She was discharged from hospital on 7th December, 1969, and follow-up has shown that the retina remained flat and the vision of the right eye in April, 1970, was 6/24 with correcting lenses.

If diathermy had been used to seal this hole, destruction of the macula would have been inevitable and hence there would have been no hope of rescuing any central vision in the eye.

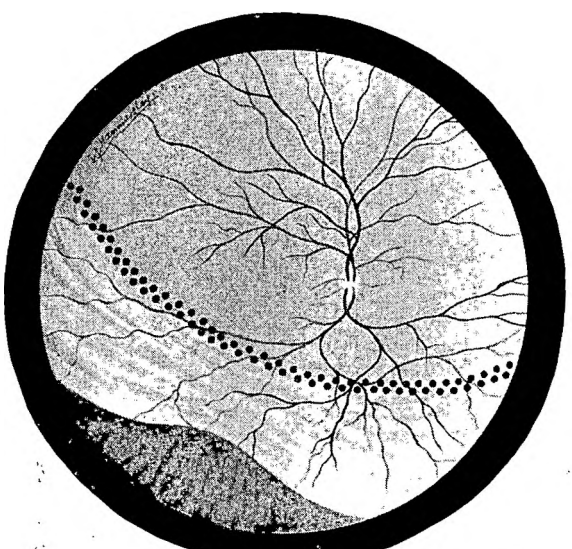


Fig. 2—Retinal dialysis may be limited by multiple rows of phototherapy applications.

Fig. 4—Peripheral degeneration and foci of retinal pathology are simply treated by phototherapy.

SUMMARY

A case of detached retina in a young European female has been successfully overcome by the use of laser, where a previous operative procedure had failed to produce a lasting cure.

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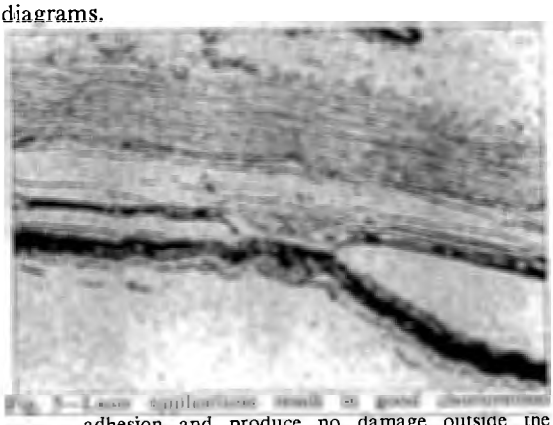
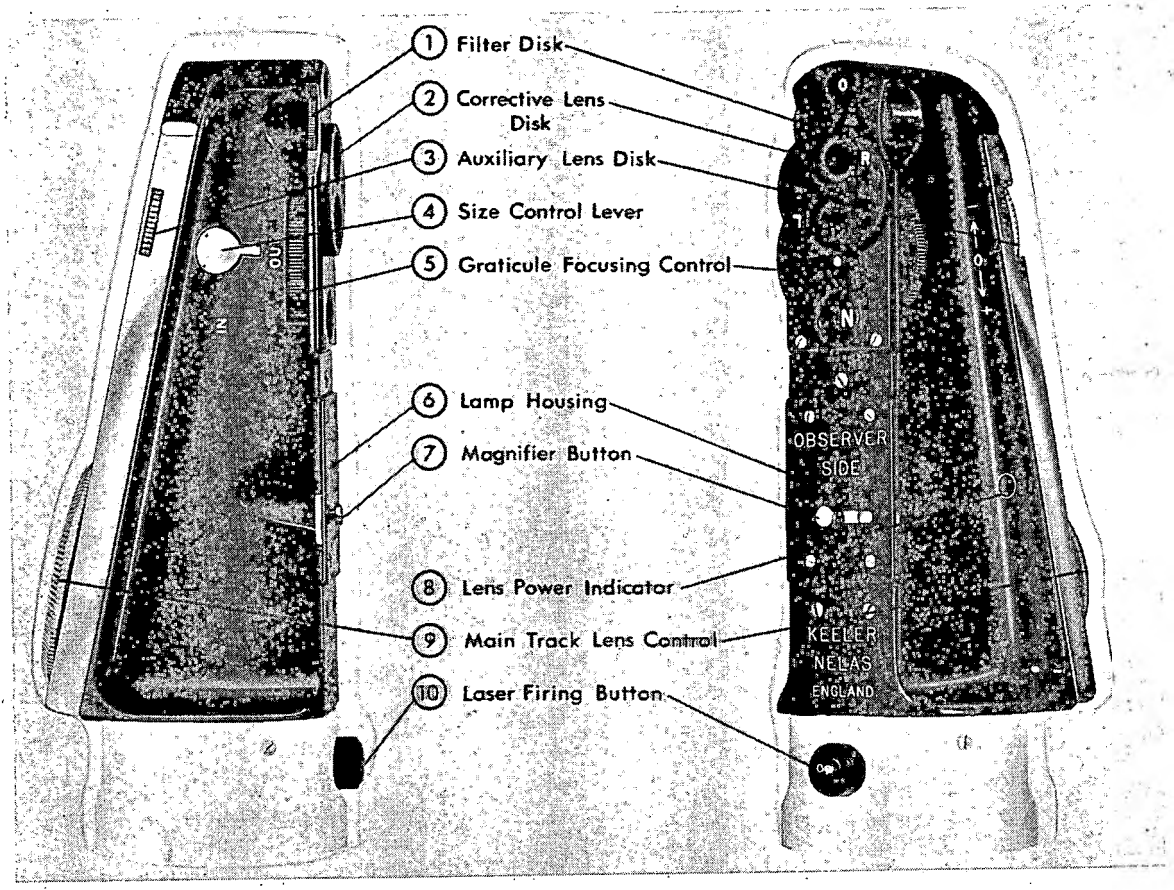


adhesion and produce no damage outside the immediate area of the application. It has little effect on the choroidal vessels and the internal limiting membrane is unaffected.



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